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IMPURITY SEGREGATION AND ITS EFFECTS ON THE OPTICAL PROPERTIES OF KH_2PO_4

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Numerous investigations have shown that trivalent actions such as Al, Cr and Fe are preferentially incorporated into {100} sectors of KH_2PO_4 (KDP) resulting in high UV absorption. Other research has indicated that impurities directly influence the laser induced damage threshold. Here we present the results of ICP mass spectroscopy, SIMS analyses, UV spectroscopy, X-ray topography and index homogeneity measurements which identify and quantify the UV active species in {100} and {101} sectors of KDP crystals as well as their effects on optical properties and laser-induced damage. We find that Fe, Al and Zr levels strongly correlate with optical absorption at 270nm and increase monotonicly with growth rate. In contrast, the distributions of Sb, Cr and heavy metals such as Cs and La are correlated with optical absorption at 200nm and don't depend on growth rate. The levels (≤ 5ppm) of all of the impurities, except for Rb and As, are considerably higher in {100} sectors. These variations in impurity levels are shown to lead to inhomogeneities in the refractive indices generating phase distortions of transmitted light as well as low thresholds for laser damage at the sector boundaries. However, following thermal annealing at 150°C, the damage threshold of the boundaries becomes equal to that of the surrounding material suggesting that stresses at the interface generated by these impurity differences are relieved by thermal annealing. Also, The result of photoemission studies on these from those impurity-induced defects at laser fluences both below and above the laser-induced damage threshold are reported and the role of impurities in laser-induced damage will be discussed.
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